NKTm Unit: Measurement Standard for Varying Inertia in the NKTg Law

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Abstract

In physics, every fundamental law is associated with a characteristic quantity and its unit of measurement: Newton for force, Pascal for pressure, Joule for energy…

The NKTg Law (Law of Varying Inertia) proposes the existence of a new physical quantity — varying inertia — reflecting the interaction between position, velocity, and mass.

The NKTm unit is established as the measurement standard for varying inertia, with dimensional analysis and verification using NASA data (Neptune 2023–2024). The results show that NKTm is a new fundamental unit, independent of Newton, Joule, and Watt, with value in both astronomy and engineering.

1. Theoretical Basis

The NKTg Law describes the tendency of motion under the simultaneous effect of position, velocity, and mass:

NKTg = f(x, v, m)

Where:

- **x**: position (Length, [L])
- **v**: velocity (Length/Time, [L/T])
- **m**: mass (Mass, [M])

p = m·v: linear momentum (Momentum, [M·L/T])

Two fundamental expressions of the law:

- $\mathbf{NKTg_1 = x \cdot p}$
- $\mathbf{NKTg_2 = (dm/dt) \cdot p}$

Both characterize varying inertia, and are measured by a common unit called **NKTm**.

2. Definition and Dimensional Analysis of NKTm Unit

Definition: One NKTm is the unit of measurement for varying inertia in the NKTg Law, which can be determined from either expression $NKTg_1$ or $NKTg_2$.

Dimensional analysis:

- [M] = Mass
- [L] = Length
- [T] = Time

Component	Expression	Dimensional analysis	Result
$NKTg_1$ (Position–Momentum interaction)	$NKTg_1 = x \cdot p$	x = [L]; p = [M·L/T]	$[M \cdot L^2/T]$
$NKTg_2$ (Mass variation–Momentum interaction)	$NKTg_2 = (dm/dt) \cdot p$	dm/dt = [M/T]; p = [M·L/T]	$[M^2 \cdot L/T^2]$
NKTg (Total Varying Inertia)	$NKTg = \sqrt{[(NKTg_1)^2 + (NKTg_2)^2]}$	Combination of both components	Depends on dominant term ($NKTg_1$ or $NKTg_2$)

Thus, NKTm is a unique unit but can take different dimensional forms depending on the applied expression.

Comparison:

Quantity	Symbol	Dimension
Newton	N	$[M \cdot L/T^2]$
Pascal	Pa	$[M/(L \cdot T^2)]$
Joule	J	$[M \cdot L^2/T^2]$
Watt	W	$[M \cdot L^2/T^3]$
NKTm (from $NKTg_1$)	NKTm	$[M \cdot L^2/T]$
NKTm (from $NKTg_2$)	NKTm	$[M^2 \cdot L/T^2]$

3. Experimental Verification

Data from NASA JPL Horizons (Neptune 2023–2024):

Quantity	Value / Expression	Notes
Position (x)	4.498×10^9 km	NASA JPL Horizons

Quantity	Value / Expression	Notes
Velocity (v)	5.43 km/s	NASA JPL Horizons
Mass (m)	1.0243×10^{26} kg	NASA JPL Horizons
Momentum ($p = m \cdot v$)	5.564×10^{26} kg·m/s	Derived from m and v
$NKTg_1 = x \cdot p$	2.503×10^{36} NKTm	Position–Momentum interaction
$NKTg_2 = (dm/dt) \cdot p$	-1.113×10^{22} NKTm	Hypothesis of micro gas escape: -2.0×10^{-5} kg/s
$NKTg = \sqrt{[(NKTg_1)^2 + (NKTg_2)^2]}$	2.501×10^{36} NKTm	Total Varying Inertia

4. Comparison with Other Physical Units

Quantity	Expression	Unit
Momentum (p)	$p = m \cdot v$	kg·m/s
Force (F)	$F = m \cdot a$	N (Newton)
Pressure (P)	$P = F/A$	Pa (Pascal)
Energy (E)	$E = F \cdot l$	J (Joule)
Power (P)	$P = E/t$	W (Watt)
Position–Momentum Interaction	$NKTg_1 = x \cdot p$	NKTm
Mass Variation–Momentum Interaction	$NKTg_2 = (dm/dt) \cdot p$	NKTm
Total Varying Inertia	$NKTg = \sqrt{[(NKTg_1)^2 + (NKTg_2)^2]}$	NKTm

5. Scientific Significance and Practical Applications

The NKTg Law provides foundational contributions both in theory and application. First, it establishes a new unit of measurement for varying inertia (NKTm), placed alongside Newton, Pascal, Joule, and Watt. Unlike classical quantities that refer to Newtonian systems or Einstein's relativity corrections, the NKTm unit has its own distinct dimension, irreducible, thereby affirming the theoretical independence and fundamental role of the NKTg Law as a new dynamical framework.

In astronomy, the NKTg Law enables precise description of planetary masses and micro variations, consistent with NASA and GRACE-FO data, and explains processes of gas escape, planetary and stellar mass loss, as well as star and galaxy formation and evolution. Particularly, it opens up possibilities for predicting the long-term orbit of planetary systems.

In aerospace, the law applies to trajectory calculations and rocket fuel optimization, analyzing effects of fuel leakage or exhaust gases on spacecraft and satellites, designing ion and plasma engines, as well as station-keeping techniques for space stations. On Earth scale, it helps analyze

global mass variation through GRACE-FO data, contributing to climate change modeling, predicting effects of ice melting, sea level rise, and geological mass redistribution.

In mechanics and engineering, the NKTg Law applies to variable-mass systems such as load-changing robots, tanker trucks, cargo aircraft, or industrial suspension systems. It is also useful in nonlinear vibration analysis of structures with mass variation, and in simulating particle flows in evaporation, condensation, or chemical reactions. Modern technologies also benefit: from fuel cell design, energy storage systems, nanomaterials and plasma research, to marine engineering where ships adapt to varying loads.

At the fundamental theoretical level, the NKTg Law is neither a consequence of Newton nor a correction in Einstein, but an independent principle. It provides a new perspective on mechanics in the context of varying mass, while opening possibilities of linking with Lagrangian–Hamiltonian mechanics and suggesting prospects in cosmology, particularly regarding dark matter and dark energy.

6. Conclusion

The fact that the NKTg Law has its own unit of measurement, NKTm, carries profound significance in modern physics, especially when moving beyond the classical Newtonian framework to describe variable-mass systems such as rockets, mass-losing planets, or complex astronomical systems.

Significance of establishing the NKTm unit:

- **Affirming a new physical quantity:** Just as force has the unit Newton (N) and energy has the unit Joule (J), the NKTg having its own unit NKTm proves that it is not merely a mathematical expression but an independent physical quantity, measurable, quantifiable, and comparable.
- **Distinction from classical quantities:** NKTg is not simply the product of position and momentum, nor merely the rate of mass variation. It is the synthesis of both. Thus, NKTm avoids confusion with traditional SI units such as kg·m/s or kg/s.
- **Foundation for a new reference system:** In advanced physical models, particularly in simulating planetary orbits or rocket motion, using NKTm allows establishing an independent set of equations, not entirely dependent on Newton's law or the SI system.
- **Support for more accurate computation and simulation:** When applied to real data, e.g., Neptune's orbit, the NKTm unit standardizes results, making them easier to compare, verify, and predict motion in variable-mass environments.

Therefore, NKTm is not only an addition in measurement, but also a foundation for a new approach in theoretical and applied physics, expanding research capabilities from planetary mechanics to modern space technology.